

REMARKS/ARGUMENTS

THE INVENTION

Claims 1-27 are pending in the instant application.

The present invention resides in an adjustable cam shaft which allows the displacement angle between cam lobes to be altered without the need to replace the cam shaft, thus allowing intake and exhaust timing to be altered to meet the intended performance of the engine for given conditions. Generally, the adjustable cam shaft of the present invention comprises an elongated shaft having a first cam lobe carried by the shaft, and a second lobe carried by the shaft. The first and second cam lobes are selectively rotatable relative to one another and selectively locked in place relative to one another, allowing the displacement angle between the cam lobes to be selectively adjusted.

In one embodiment, the cam lobes, which comprise intake cam lobes associated with intake valves of an engine, and exhaust lobes associated with exhaust valves of an engine, are carried by an elongated shaft. The shaft is attached to a drive/timing gear assembly which includes a gear and hub. An inner shaft may extend through the elongated shaft for attachment to an engine block.

Indicia are associated with each of the cam lobes for determining the displacement angle between the cam lobes as they are rotated and adjusted relative to one another. Means for locking the cam lobes to the shaft, and relative to one another, are provided. Such locking means may comprise a locking nut threadably received onto the shaft, such that a shoulder on an opposite end of the shaft compresses the cam lobes against the drive/gear assembly so as to lock the cam lobes relative to one another. A pin may also be insertable through a drive/gear assembly and either into the first or second cam lobe for setting the position of the cam lobe relative to the drive/gear assembly.

In another embodiment, the elongated shaft comprises multiple shaft sections, each shaft section having at least one cam lobe extending therefrom. For example, a first shaft section may have either an intake or exhaust cam lobe extending therefrom, and a second shaft section may

have an intake or exhaust cam lobe extending therefrom and which is rotatable with respect to the first shaft section. Means are provided for locking the first and second shaft sections relative to one another.

The first shaft section includes a shaft extending therefrom, and the second shaft section includes a hollow sleeve extending therefrom configured to accept the shaft therein such that the first and second shaft sections are rotatably associated with one another. The first shaft section includes degree indicia which are linable with degree indicia of the second shaft section to determine the relative displacement angle of the cam lobes. The first and second sections include hollow, internally threaded portions that receive an externally threaded bolt fastener that locks the first and second sections relative to one another once the desired displacement angle of the lobes has been achieved by rotating the shaft sections. A timing gear is attached to an end of the cam shaft for driving the cam shaft.

Thus, the invention allows the timing of the intake lobe relative to the exhaust lobe to be adjusted without replacement of the entire cam shaft. In fact, the timing of each lobe for each valve between the various cylinders of the internal combustion engine can be variable and fine-tuned to meet the performance requirements of the engine.

THE OFFICE ACTION

Claims 1-15, 21-27 were rejected under 35 USC 102(b) as being anticipated by Suzuki (US Pat. No. 6,343,581). The Office Action states that, regarding claims 1, 21, Suzuki discloses an elongated shaft (See Figure 2 (66)); a first (See Figure 2 (83)) cam lobe carried by the shaft; a second cam lobe (See Figure 2 (86)) carried by the shaft; and means (See Figure 3 (90), Figure 5 (96), Abstract, col. 4, lns. 1-19) for locking the first and second cam lobes to the shaft; wherein either the first or second cam lobe comprises an intake cam lobe (See Figures 1, 2 (66), (59)) associated with an intake valve of an engine, and the other cam lobe (See Figure 1 (81), (72), col. 3, lns. 59-67, col. 4, lns. 1-3, 16-31) comprises an exhaust lobe associated with an exhaust valve of an engine; and wherein the first and second cam lobes are selectively (See Abstract, Col. 1, lns. 56-63) rotatable relative to one another and selectively locked in place relative to

one another, whereby a displacement angle between the cam lobes can be selectively adjusted.

LAW OF ANTICIPATION

In order to anticipate a claim, the reference must teach each element of the claim. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). The elements must be arranged as required by the claim, but this is not an ipsissimis verbis test, i.e., identity of terminology is not required. *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed. Cir. 1990).

ARGUMENTS

With respect to the rejections of claims 1, 6 and 21, claims 1 and 21 each require that the first and second cam lobes are selectively rotatable relative to one another and selectively locked in place relative to one another, whereby a displacement angle between the cam lobes can be selectively adjusted. Suzuki does not disclose this feature. The relevant portion of Suzuki merely states that a coupling device is provided for selectively permitting relative rotational movement between the camshaft and the second cam so that the first cam controls the entire opening and closing cycle of the poppet valve and for coupling the second cam for rotation with the camshaft about the camshaft axis so that the second cam controls at least a part of the opening and closing operation of the poppet valve. There is no mention or suggestion that the first and second cam lobes are selectively rotatable relative to one another and selectively locked in place relative to one another such that a displacement angle between the cam lobes can be selectively adjusted.

Additionally, the Office Action attempts to substitute the cams 83, 86 of Suzuki for the claim language which distinctly refers to first and second cam lobes.

Also, the Office Action fails to recognize the clear language of claim 1 which refers to a single elongated shaft while the features referred to in Suzuki are two distinct camshafts: intake camshaft assembly 66 and exhaust camshaft assembly 81. There is no teaching in Suzuki of a single camshaft as is claimed by the Applicant. The Office Action is erroneously applying this dual camshaft reference to the single shaft of claim 1.

The Office Action also fails to address the recitation of claim 21 that in "either the first or second cam lobe comprises an intake cam lobe associated with an intake valve of an engine, and the other cam lobe comprises an exhaust lobe associated with an exhaust valve of an engine." In particular, how do Figures 1 and 2 of Suzuki, reference number 66 (intake camshaft assembly), reference number 59 (intake valves), reference number 81 (exhaust camshaft assembly) and reference number 72 (exhaust valves) allegedly disclose that either the first or second cam lobe comprises an intake cam lobe associated with an intake valve of an engine, and the other cam lobe comprises an exhaust lobe associated with an exhaust valve of an engine. The Office Action attempts to substitute the cams 83, 86 of Suzuki for the claim language which distinctly refers to first and second cam lobes. Also, the Office Action fails to recognize the clear language of claim 1 which refers to a single elongated shaft while the features disclosed by refer to two distinct camshafts: intake camshaft assembly 66 and exhaust camshaft assembly 81. There is no teaching in Suzuki of a single camshaft as is claimed by the Applicant.

Claims 6 and 21 each require means for locking the first and second cam lobes to the shaft. The Office Action states that Suzuki allegedly discloses means for locking the first and second cam lobes to the shaft in the pins 90 of Figure 3, the locating plunger 96 of Figure 5, the Abstract and in col. 4, lines 1-19. However, the Office Action fails to indicate how these individual components are the alleged locking means.

Therefore, in view of the foregoing, it is respectfully requested that the rejections of claims 1, 6 and 21 be withdrawn as the reference fails to anticipate the claims.

With respect to claim 2, the Office Action states that Suzuki discloses a drive timing gear (See Figure 2 (51)) assembly carried by the shaft and associated with the first and second cam lobes. However, the Office Action fails to indicate how Figure 2 and reference number 51, which refers to the engine, allegedly disclose a drive/timing gear carried by the shaft. The Office Action also fails to describe with particularity how the alleged drive timing gear is associated with the first and second cam lobes.

Regarding claims 3 and 22, the Office Action states that Suzuki discloses a drive/timing gear assembly including a gear and a hub fastened to one another (See Figure 2 (51), (87)). However, the Office Action fails to state with particularity how Figure 2 and reference number 51 (the engine), and reference number 87 (a toothed sprocket), allegedly disclose that the drive/timing gear carried by the shaft includes a gear and a hub fastened to one another.

With regard to claim 4, the Office Action states that Suzuki discloses either the first or second cam lobe comprises an intake cam lobe (See Figures 1, 2 (66), (59)) associated with an intake valve of an engine, and the other cam lobe (See Figure 1 (81), (72)) comprises an exhaust lobe associated with an exhaust valve of an engine. However, once again the Office Action fails to state with particularity how Figures 1 and 2, reference number 66 (intake camshaft assembly), reference number 59 (intake valves), reference number 81 (exhaust camshaft assembly) and reference number 72 (exhaust valves) allegedly disclose that either the first or second cam lobe comprises an intake cam lobe associated with an intake valve of an engine, and the other cam lobe comprises an exhaust lobe associated with an exhaust valve of an engine. As noted above, the Office Action attempts to substitute the cams 83, 86 of Suzuki for the claim language which distinctly refers to first and second cam lobes. Also, the Office Action fails to recognize the clear language of claim 1 which refers to a single elongated shaft while the features disclosed by refer to two distinct camshafts: intake camshaft assembly 66 and exhaust camshaft assembly

81. There is no teaching in Suzuki of a single camshaft as is claimed by the Applicant.

With respect to claims 5, 23, the Office Action states that Suzuki discloses indicia associated with each of the first and second cam lobes for determining the displacement angle of the cam lobes (See Figure 2 (85)). However, the Office Action fails to state with particularity how Figure 2 and the intermediate eccentric bearing 85 of Suzuki allegedly disclose indicia associated with each of the first and second cam lobes for determining the displacement angle of the cam lobes. Suzuki simply does not disclose indicia associated with each of the first and second cam lobes for determining the displacement angle of the cam lobes.

In regard to claims 7, 24, the Office Action states that Suzuki discloses the locking means comprises a locking nut (See Figure 2 (84)) threadedly received onto the shaft. Once again, the Office Action does not state with particularity how Figure 2 and the barrel-shape non-cam portion 84 of Suzuki allegedly disclose a locking means comprising a locking nut threadedly received onto the shaft. Suzuki simply does not show a locking means comprising a locking nut threadedly received onto the shaft.

With respect to claims 8 and 25, the Office Action states that Suzuki discloses the shaft includes an externally threaded portion (See Figure 2 (84)) for receiving the locking nut, and a shoulder (See Figure 2 (85)) on an opposite end thereof, whereby as the locking nut is tightened onto the shaft, the shoulder compresses the first and second cam lobes (See Figure 2 (83), (86)) against a drive/gear (See Figure 2 (51)) assembly so as to lock the first and second cam lobes relative to one another. Here again, the Office Action fails to state with particularity how Figure 2, the barrel-shape non-cam portion 84, the intermediate eccentric bearing 85, low speed cams 86 and engine 51 of Suzuki allegedly disclose the shaft including an externally threaded portion for receiving the locking nut, and a shoulder on an opposite end thereof, whereby as the locking nut is tightened onto the shaft, the shoulder compresses the first and second cam lobes against a drive/gear assembly so as to lock the first and second cam lobes relative to one another. Suzuki simply does not disclose such structure.

In regard to claims 9 and 26, the Office Action states that Suzuki discloses a pin (See Figures 3, 5 (90), (96)) insertable through a drive/gear assembly and into either the first or second (See Figure 2 (83), (86)) cam lobe for setting the position of the first or second cam lobe relative to the drive/gear (See Figure 2 (51)) assembly. However, the Office Action fails to state with particularity how Figures 2, 3 and 5, pins 90, locating plunger 96, the high speed cams 83, and the low speed cams 86 of Suzuki allegedly disclose a pin insertable through a drive/gear assembly and into either the first or second cam lobe for setting the position of the first or second cam lobe relative to the drive/gear assembly. Once again, Suzuki does not show such structure.

Regarding claims 10 and 27, the Office Action states that Suzuki discloses an inner shaft (See Figure 3 (113)) extending through the elongated shaft for attachment to an engine block. The Office Action fails to state with particularity how Figure 3 and fluid passageway 113 of Suzuki allegedly disclose an inner shaft extending through the elongated shaft for attachment to an engine block. Again, Suzuki does not disclose such structure.

With regard to claim 11, the Office Action states that Suzuki discloses the elongated shaft (See Figure 2(66)) comprises first and second shaft sections, the first cam lobe (See Figure 2 (83)) extending from the first shaft section, and the second cam lobe (See Figure 2 (86)) extending from the second shaft section, and wherein the shaft sections are rotatably associated with one another and selectively locked in place relative to one another (See Abstract, col. 1, Ins. 56-63). The Office Action fails to state with particularity how the listed figures and components of Suzuki allegedly disclose the elongated shaft comprising first and second shaft sections, the first cam lobe extending from the first shaft section, and the second cam lobe extending from the second shaft section, and wherein the shaft sections are rotatably associated with one another and selectively locked in place relative to one another. Suzuki simply fails to disclose such structure.

Regarding claim 12, the Office Action states that Suzuki discloses the first shaft (See Figure 3 (113)) section includes a shaft extending therefrom, and the second shaft (See Figure 2 (66)) section includes a

hollow sleeve extending therefrom and configured to accept the shaft therein. Again, the Office Action fails to state with particularity how the listed figures and components of Suzuki allegedly disclose the first shaft section includes a shaft extending therefrom, and the second shaft section includes a hollow sleeve extending therefrom and configured to accept the shaft therein. Suzuki simply does not disclose such structure.

With respect to claim 13, the Office Action states that Suzuki discloses means for locking (See Figure 5 (105)) the first and second shaft sections relative to one another. The Office Action fails to state with particularity how the listed figures and components of Suzuki allegedly disclose means for locking the first and second shaft sections relative to one another. Suzuki does not disclose such structure.

Regarding claim 14, the Office Action states that Suzuki discloses the locking means comprises a fastener (See Figure 5 (84)) attachable to the first and second shaft sections. However, the Office Action fails to state with particularity how Figure 5 and the barrel-shape non-cam portion 84 of Suzuki allegedly discloses the locking means comprising a fastener attachable to the first and second shaft sections. Suzuki simply does not disclose such structure.

Regarding claim 15, the Office Action states that Suzuki discloses the first (See Figure 3 (113)) and second shaft (See Figure 2 (66)) sections include hollow, internally threaded (See Figure 5 (93)) portions that receive the fastener. However, the Office Action fails to state with particularity how the Figures 2, 3 and 5 and the fluid passageway 113, intake camshaft assembly 66, and heel portion 93 of the high speed cams of Suzuki allegedly discloses that the first and second shaft sections include hollow, internally threaded portions that receive the fastener. Again, Suzuki simply does not disclose such structure.

Claims 16-20 were rejected under 35 USC 102(e) as being anticipated by Methley et al. (U.S. Pat. No. 6,725,817). Methley et al. fails to teach each and every element of the claims when given the broadest reasonable interpretation of each claim.

Regarding claim 16, the Office Action states that Methley discloses a first (See Figure 1 (12)) shaft section having a cam lobe (See Figure 1 (16))

extending therefrom; a second shaft (See Figure 1 (14)) section having a cam lobe (See Figure 1 (18)) extending therefrom; and means for locking (See Figure 1 (20)) the first and second shaft sections relative to one another; wherein either the first or second cam lobe comprises an intake cam lobe associated with an intake valve of an engine (See col. 5, Ins. 36-45), and the other cam lobe comprises an exhaust lobe associated with an exhaust valve of an engine (See col. 5, Ins. 36-45); and wherein the first and second shafts are selectively (See Abstract, Col. 2, Ins. 51-67, col. 3, Ins. 1-9, col. 5, Ins. 21-24) rotatable relative to one another and selectively locked in place relative to one another, whereby a displacement (See Abstract, col. 2, Ins. 51-67, col. 3, Ins. 1-9, col. 5, Ins. 21-24) angle between the cam lobes can be selectively adjusted. However, the Office Action fails to state with particularity how the list figures and components of Methley allegedly discloses the structure as recited in the claim. Methley simply fails to disclose a first shaft section having a cam lobe extending therefrom; a second shaft section having a cam lobe extending therefrom; and means for locking the first and second shaft sections relative to one another; wherein either the first or second cam lobe comprises an intake cam lobe associated with an intake valve of an engine, and the other cam lobe comprises an exhaust lobe associated with an exhaust valve of an engine; and wherein the first and second shafts are selectively rotatable relative to one another and selectively locked in place relative to one another, whereby a displacement angle between the cam lobes can be selectively adjusted. The listing of components in the Office Action do not show, teach or suggest the structure claimed.

Regarding claim 17, the Office Action states that Methley discloses a drive/timing gear assembly comprising a gear (See Figure 1 (32)) and a hub (See Figure 1 (38), (40)) attached to either (See col. 2, Ins. 51-67, col. 3, Ins. 1-9) the first or second (See Figure 1 (12), (14)) shaft section. Once again, the Office Action fails to state with particularity how the list figures and components of Methley allegedly discloses a drive/timing gear assembly comprising a gear and a hub attached to either the first or second shaft section. Methley does not disclose such structure.

In regards to claim 18, the Office Action states that Methley discloses indicia (See Figure 3 (44)) associated with each of the first and second shaft (See Figure 1 (12), (14)) sections for determining the displacement angle of the cam lobes (See Figure 1 (16), (18)). The Office Action fails to state with particularity how the list figures and components of Methley allegedly discloses indicia associated with each of the first and second shaft sections for determining the displacement angle of the cam lobes. Again, Methley simply does not disclose such structure.

With regard to claim 19, the Office Action states that Methley discloses the first shaft (See Figure 1 (14)) section includes a shaft extending therefrom, and the second shaft (See Figure 1 (12)) section includes a hollow sleeve extending therefrom and configured to accept the shaft therein. Again, the Office Action fails to state with particularity how the list figures and components of Methley allegedly discloses the first shaft section includes a shaft extending therefrom, and the second shaft section includes a hollow sleeve extending therefrom and configured to accept the shaft therein. Methley simply fails to disclose such structure.

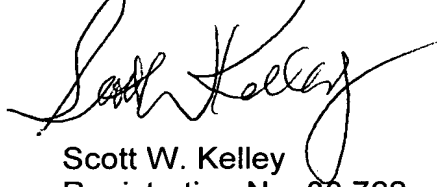
Finally, with respect to claim 20, the Office Action states that Methley discloses the first (See Figure 1 (14)) and second shaft (See Figure 1 (12)) sections include hollow, internally threaded portions, and wherein the locking means comprises a fastener (See Figure 1 (20)) received within the first and second shaft sections. The Office Action fails to state with particularity how the list figures and components of Methley allegedly discloses the first and second shaft sections include hollow, internally threaded portions, and wherein the locking means comprises a fastener received within the first and second shaft sections. Once again, Methley simply fails to disclose such structure.

CONCLUSION

In view of the foregoing arguments, the present invention, as claimed, is clearly distinguishable from the prior art references. Accordingly, Applicant believes that all pending claims 1-27 are in condition for allowance, notice of which is hereby respectfully requested.

Respectfully submitted,

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A handwritten signature in black ink, appearing to read "Scott W. Kelley", is written over the printed name.

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